

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 10, 1908.—“The Extension of Cracks in an Isotropic Material.” By A. Mallock, F.R.S.

Any specified strain in a solid can be represented as a combination of shear and volume extension or compression, and both for volume extension and shear there are limits which if exceeded either cause rupture or leave the material in an altered condition when the stress is removed.

There is, however, no known limit of rupture for the volume compression of solids.¹

It would be a matter of interest and importance to determine for solids whether, and how far, the existence of one form of strain influenced the limits of the other, whether, for instance, a body subjected to volume extension would require more or less shear to rupture it than when the volume was normal.

This point has not, so far as the author knows, been made the subject of experiment, but for the purpose of this note it is assumed that if a strain which exceeds either of the limits is applied to a solid, rupture will be due to that property of the substance for which the limit is least, and that if the distortion limit is the smaller of the two, breakage will occur at right angles to the lines of greatest extension, whereas if the volume limit is the least the direction of the break will be indeterminate.

If the conditions of strain at the end of the crack are such that material gives way from over-distortion, the fracture will occur in the plane of the existing crack, which will therefore spread continuously, while if the over-dilatation is the origin the breakage may take place in any direction. If at any place the plane of the new fracture cuts the plane of the crack there will be a re-arrangement of stresses, and a relatively considerable length of material will have to be strained before further rupture is possible, and thus the cross-fractures will act as a bar to the further extension of the crack.

It is concluded, therefore, that in materials such as glass or other substances in which cracks spread in nearly constant directions rupture is due to the distortion limit, and that where a crack extends with difficulty in a wandering manner the dilatation limit is the one which has been exceeded.

The rapid alteration of the direction in which fracture takes place may give rise to the fibrous appearance which often shows itself on broken surfaces in such cases.

When the limits for both μ and κ are reached at nearly the same time, a very small change in either, such as might occur in a body nearly, but not quite, homogeneous, would alter altogether the appearance of a fracture.

In this note only isotropic materials are considered, but it seems probable that the same principles might be used to explain the cleavage of crystals.

Challenger Society, January 27.—Sir John Murray in the chair.—Notes on the breeding habits and development of *Littorina littorea*: W. M. Tattersall. On changing the water in the aquarium for fresh sea-water, copulation of the periwinkles was readily induced. The eggs are deposited in small capsules shaped like a panama hat, and are not attached, which accounts for their not having been recorded hitherto. Of the four British species of *Littorina*, *littorea* is exposed only at low spring tides, and is freed as a trochosphere, later becoming a veliger; *obtusata* is generally exposed at ordinary low water, and is freed as a veliger; *rudis* is exposed during the greater part of the day, and is viviparous; *neritoides* lives between the high water of springs and neaps, and is also viviparous. Both in habitat and life-history these four seem to represent stages in adaptation to a land existence.—British Oithonæ: G. P. Farran. It was pointed out that they are four in number, and inhabit, respectively, waters of low salinity, ordinary coastal waters, oceanic waters bordering on the coastal area, and purely oceanic waters. Structural modifications accompany the increase in salinity

¹ This may give an explanation of the difference between malleability and ductility. Under the hammer the strain is a shear combined with volume compression, while in “drawing” the material undergoes shear combined with volume dilatation. In general, a body which is ductile will also be malleable, but the converse need not hold.

of the different habitats.—The four species of Polychætes from the N.E. Atlantic: S. W. Kemp. Notes on their habits and on the structure of the vestigial eye.

Zoological Society, February 2.—Mr. F. Gillett, vice-president, in the chair.—Christmas Island: Dr. C. W. Andrews. Attention was directed to the differences in the fauna associated with influx of population.—Preliminary account of the life-history of the leaf-insect, *Phyllium crurifolium*, Serville: H. S. Leigh. The leaf-insects occur in the tropical regions of the Old World, and seem partial to insular life. The eggs, which resemble the seeds of certain plants to a remarkable degree, require to be kept in a constantly warm and moist atmosphere to enable them to hatch; they hatch very irregularly, and the period of incubation often extends over three or four months. When young the larvæ are active as compared with older individuals. The metamorphosis is incomplete, and the adult form is attained by a gradual increase in size; fully developed tegmina and wings only appear in the adult condition. The adult females are large and leaf-like in appearance, but the males are much smaller, and not foliaceous.—The mammals of Matabeleland: E. C. Chubb.—Pathological observations at the society's gardens during 1908: Dr. H. G. Plimmer.

Linnean Society, February 4.—Dr. A. Smith Woodward, F.R.S., vice-president, in the chair.—*Fucus spiralis*, Linné, or *Fucus platycarpus*, Thuret; a question of nomenclature: Dr. Börgesen. The purport of the paper was to show that recent statements by Prof. Sauvageau as to the validity of the name *Fucus spiralis*, Linn., are not supported by the history of the plant, nor by specimens in the Linnean herbarium.—Observations on the oecology of the *Ichneumon manifestator*, Marsham (nec Linn.): an historical note: C. Morley. The writer referred to the account given in 1794 by a former secretary of the society, Thomas Marsham, of an insect observed in Hyde Park. Mr. Cockayne found recently in the same place a specimen of *Ephialtes extensor*, Tasch., a Continental species not hitherto noticed in Britain; the paper concludes by pointing out the similarity of the two occurrences, and the difficulty of clearing up the synonymy.—The Polyzoa of Madeira: Rev. Canon Norman. For more than forty years the late Mr. J. Yate Johnson was residing at Madeira, and diligently studied both its flora and fauna. He especially devoted himself to the marine fauna, and the Polyzoa did not escape him. From time to time he submitted the species which he found for determination by naturalists who specially worked at this class—first to Prof. Busk after his death to Rev. Thomas Hincks, and subsequently to Mr. Waters. The total number of species found by him was 52; the present paper contains 139. Previous writers on the Polyzoa of Madeira have been unable to give particulars as to the circumstances (habitat, depth, &c.) at which the various species lived. These particulars the author supplies as regards most of the species previously known as Madeiran. With respect to the additions now made, there are some species new to science; others previously known in the Mediterranean; others which have been recently described from the Prince of Monaco's dredgings, and two species the occurrence of which is certainly interesting.

Royal Anthropological Institute, February 9.—Prof. W. Ridgeway, president, in the chair.—Dene-holes: Rev. J. W. Hayes. It was held that these excavations were merely chalk wells or chambers from which chalk was taken for builders' mortar or for manure for the fields. The author did not contest that all the dene-holes were modern; some may well have been dug in Saxon or even in Roman times, but others were certainly not more than 100 years old, and some were dug within the last quarter of a century. Evidence was adduced to show that even at the present day the farmers in some parts of the country, Hertfordshire, for example, still get chalk for the land from similar pits. The use of chalk for building was enlarged upon, and the author was able to show that the Chislehurst caves were nothing more than an old chalk mine, the so-called altars, or steps, being merely platforms left purposely to enable the workmen to reach the roof of the cavern. The author was also able to show that where

a firm stratum of chalk, suitable for builders' lime, was found under the Thanet sand, it would pay the excavators better to make fresh shafts through the sand than to tunnel in the ordinary way and hoist the material excavated through a single shaft. The cones of sand usually found at the bottom of a dene-hole were explained as the result of the refuse of a new shaft being deliberately thrown down an old one.

Mathematical Society, February 11.—Sir W. D. Niven, president, in the chair.—The conformal transformations of a space of four dimensions and the generalisation of the Lorentz-Einstein principle: H. **Bateman** and E. **Cunningham**.—A certain family of cubic surfaces: W. H. **Salmon**.—Some fundamental properties of a Lebesgue integral in a two dimensional domain: Dr. E. W. **Hobson**.—The relation between Pfaff's problem and the calculus of variations: Prof. A. C. **Dixon**.—(1) Implicit functions and their differentials; (2) indeterminate forms: Dr. W. H. **Young**.—Modular invariants of a general system of linear forms: Prof. L. E. **Dickson**.

DUBLIN.

Royal Dublin Society, January 26.—Prof. H. H. **Dixon**, F.R.S., in the chair.—The colours of Highland cattle: Prof. James **Wilson**. Four colours go to the making of Highland cattle. These are:—(1) the original black colour; (2) a brownish-black or blackish-brown, called *donn* in Gaelic; (3) red, introduced by Anglo-Saxon cattle; and (4) light dun, a lighter or silvery-grey, probably introduced from Scandinavia. These four colours by intercrossing produce five others. Black is dominant over red, and so no new colour is produced; but light dun crossed with red produces the hybrid yellow, and crossed with black the hybrid dun (registered as dun and dark dun), while brownish-black or *donn* produces hybrid brindles with black, red, and light dun.—Note on the tensile strength of water: Prof. H. H. **Dixon**. By using Berthelot's method tensions in water were obtained amounting to more than 160 atmospheres. The range of temperature over which these tensions were observed lay between 25° C. and 80° C. The water used contained large quantities of air dissolved in it. From the nature of the experiments the tensions obtained form a minor limit for the cohesion of air-containing water, its adhesion to the conducting tubes of plants, and its adhesion to glass and copper.—A new process of contact photography: E. E. **Fournier d'Albe**. Photographs are obtained by this process of any full-toned picture, letter-press, or diagram without the use of a camera. The picture is laid on a table with its face upwards, and a sensitive plate, film, or paper is placed upon it, with the film in contact with the picture. Exposure is made by means of light from above through the back of the plate or paper. The result is a faint negative, much fogged. The negative is developed with a view to the utmost "hardness," so as to minimise the fog and bring out the design. This principle is also applied to the positive printed from the negative, and the result is a good reproduction of the original. If necessary, the remaining fog can be cleared by two more reversals, preferably with "photomechanical" plates. The final result is a reproduction in bold black and white, perfectly free from fog and free from defects inseparable from all work done with a lens. It is proposed to call the process "anastatic" photography, by analogy with a disused lithographic process of the same name.

EDINBURGH.

Royal Society, February 1.—Prof. A. Crum Brown, vice-president, in the chair.—Magnetic quality in the homogeneous hexagonal arrangement of molecular magnets: Prof. W. **Peddle**. This was a continuation along the same lines of results already given for cubical arrangements of magnetic molecules.—An improved form of magnetometer for the testing of magnetic materials: J. G. **Gray** and A. D. **Ross**. When the usual east-west arrangement of a magnetising coil with auxiliary coil is used for compensating the direct action of the solenoid on the magnetometer needle, it is very difficult to ensure the accurate alignment of the axes of the two coils so as to be absolutely certain that there is no transverse resultant magnetic force in the north-south direction. In delicate work it is important to get rid of this possible inexact com-

pensation, and at the same time to be sure that when the compensating coil is clamped in position the clamping does not bring in any change. The latter desideratum was attained by using two compensating coils at different distances from the magnetometer, the nearer one being set for rough adjustment, and the more distant one being then used for the fine and exact adjustment for balancing of the east-west fields at the position occupied by the magnetometer needle. The second adjustment was made after the nearer coil was clamped, and the sensitiveness was such that the second coil could be shifted through an appreciable distance without affecting the adjustment. The next step was to test for the existence of a north-south residual force. This was effected by first deflecting the magnetometer needle by means of a small permanent magnet suitably placed. On reversal of a powerful current through the magnetising and compensating coils, which had already been adjusted for east-west balancing, there was in general a change in the deflection, indicating the presence of a north-south component. A third coil was then suitably introduced either north or south of the magnetometer needle, and set in circuit with the other coils. By adjustment of the position of this third coil the change of deflection of the deflected needle, due to reversal of the current, could be wiped out. The small permanent magnet was then removed, and the magnetometer was in accurate adjustment for the purposes of testing magnetic quality. All the essential parts of the apparatus were mounted on a cross-shaped mahogany board, analogous in its broad features to an optical bench. Details were also given for facilitating testing from the temperature of liquid air up to high temperatures.—On the conditions for the reversibility of the order of partial differentiation: Dr. W. H. **Young**.

PARIS.

Academy of Sciences, February 8.—M. Emile Picard in the chair.—Observations of the sun, made at the Lyons Observatory, during the fourth quarter of 1908: J. **Guillaume**. The observations are summarised in three tables, giving the number of spots, their distribution in latitude, and the distribution of the faculæ in latitude. There was a much smaller total area of sun-spots visible compared with the previous quarter (3401 against 7893). Two spots were large enough to be visible to the eye unassisted.—Observations of the conjunction of Jupiter with χ Leo (4.8), made with the Brunner equatorial of the Lyons Observatory: J. **Guillaume**.—The integration of linear systems with a skew determinant: E. **Vessiot**.—The representation of a function with a real variable by a series formed with polynomials figuring in successive differential coefficients of the function e^{-x^2} : M. **Galbrun**.—A new radio-active product of the uranium series: Jacques **Danne**. In the separation of uranium X from 20 kilos. of uranium nitrate, a new radio-active substance was found, apparently the immediate parent of uranium X, for which the name radio-uranium is proposed.—The stræ of oscillating sparks: André **Léauté**. If a condenser is discharged through a coil carrying two layers of wire, the current passing through the coil has been shown by the author in a previous paper to be the sum of two sinusoidal currents. The frequency of the first is practically identical with that resulting from the application of Thomson's formula; the second has a greater frequency, and its existence furnishes a complete explanation of all the facts observed relating to stræ in induction sparks.—The mass of the negative ion of a flame: Georges **Moreau**. In a flame at a temperature of 2000° C. absolute, the mobility of the negative ion was found to be 1170 cm./volt: sec., and the velocity 2.5×10^6 cm.: sec., the numbers being probably accurate to about 10 per cent. This leads to a value (1.1×10^{-25}) gr. as the mass of the negative ion, intermediate between the atom of hydrogen, (1.4×10^{-24}) gr., and a corpuscle, (0.75×10^{-27}) , according to Perrin.—The rôle of the dissociation of the carbonophosphates in nature: A. **Barillé**. It has been shown in an earlier paper that carbonic acid combines with the phosphates of metals that are capable of forming bicarbonates, giving rise to easily dissociable compounds, the carbonophosphates. The intervention of these compounds is discussed as regards the formation of certain calculi, the absorption of carbon dioxide by the blood, sediments in urine, and as affecting

the nutrition of plants.—The combinations of gold with bromine: Fernand **Meyer**. The final product of the action of excess of bromine on gold is pure AuBr_3 . This is soluble in bromine and volatile in an atmosphere of bromine at about 300°C . At temperatures at which AuBr_3 dissociates, two bromides only appear to exist, AuBr_2 and AuBr , the dissociation curves of which have been studied. There is no evidence of the existence of AuBr_2 .—The coking power of coals: O. **Boudouard**. Coal was extracted with various organic solvents, of which only one, pyridine, dissolved an appreciable amount. The coking power of the extracted coal was unaffected.—Indigoid colouring matters derived from phenyl-isoxazalone: A. **Wahl**.—The chemical composition of colloidal silver: G. **Rebière**. A study of the electrical conductivity of solutions of colloidal silver prepared by Bredig's method leads to the conclusion that a part of the silver is in solution as oxide, or possibly carbonate.—The fertilisation of the poppy flower: Paul **Becquerel**.—The presence of amylase in old seeds: MM. **Brocq-Rousseau** and Edmond **Gain**. Wheat, fifty years old and incapable of germination, still contains diastases capable of transforming starch into sugar.—The gastric digestion of human milk and asses' milk: Louis **Gaucher**. The casein of these milks resembles that of cows' milk in not being peptonised in the stomach. Their great digestibility is due to the casein forming very small clots in the case of human milk, or a clot very easily broken up in the milk of the ass.—Parasitic protozoa of the intestine of the lobster: L. **Léger** and O. **Duboscq**.—The regeneration of the anterior part of the body in the Chetoptera: Ch. **Gravier**.—Some Plumulariidae of the British Museum collection: Armand **Billard**.—A new protozoa from *Ctenodactylus gondi*: C. **Nicolle** and L. **Manceaux**.—The chemical treatment of bile. The separation of the biliary acids: M. **Piettre**.—The hypotensive action of d'Arsonvalisation in permanent arterial hypertension: M. **Letulle** and A. **Moutier**. The arterial pressure in these experiments was measured for each case with two independent instruments of different construction; the figures obtained were practically identical. The treatment with high-frequency current always caused a reduction in the arterial pressure.—Antimony in syphilis: Paul **Salmon**. Antimony in the form of tartar emetic is of service in the cure of syphilis, but in certain cases there is a rapid relapse.—The geology of Agôoué: M. **Arsandaux**.

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 18.

ROYAL SOCIETY, at 4.30.—On the Osmotic Pressures of Calcium Ferrocyanide Solutions, Part II. Weak Solutions: Earl of Berkeley, F.R.S., E. G. J. Hartley and J. Stephenson.—On the Spontaneous Crystallisation of Monochloroacetic Acid and its Mixtures with Naphthalene: Prof. H. A. Miers, F.R.S., and Miss F. Isaac.—An Apparatus for Measurements of the Defining Power of Objectives: J. de G. Hunter.—On Best Conditions for Photographic Enlargement of Small Solid Objects: A. Mallock, F.R.S. ROYAL INSTITUTION, at 3.—Problems of Geographical Distribution in Mexico: Dr. Hans Gadaw, F.R.S. LINNEAN SOCIETY, at 8.—Discussion on Alternation of Generations: opened by Dr. W. H. Lang.

FRIDAY, FEBRUARY 19.

ROYAL INSTITUTION, at 9.—Recent Advances in Means of Saving Life in Coal Mines: Sir Henry Cunynghame, K.C.B. INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Annual General Meeting.—Further discussion: The Filtration and Purification of Water for Public Supply: John Don.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Standardisation in Engineering Practice: Dr. W. C. Unwin, F.R.S.

MONDAY, FEBRUARY 22.

ROYAL SOCIETY OF ARTS, at 8.—Modern Methods of Artificial Illumination: Leon Gaster. ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—A Recent Journey Across Northern Arabia: Captain S. S. Butler. INSTITUTE OF ACTUARIES, at 5.—Some Financial and Statistical Considerations of the Old Age Pension Scheme: Vyvyan Marr.

TUESDAY, FEBRUARY 23.

ROYAL INSTITUTION, at 3.—The Evolution of the Brain as an Organ of Mind: Prof. F. W. Mott, F.R.S.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Man and the Glacial Period: W. Allen Sturge.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Further discussion: The Design of Marine Steam-Turbines: S. J. Reed.—Probable Paper: Some recent Grain-handling and Storing Appliances at the Millwall Docks: M. Mowat.

WEDNESDAY, FEBRUARY 24.

ROYAL SOCIETY OF ARTS, at 8.—Hand-made Papers of Different Periods: Clayton Beadle and Henry P. Stevens.

GEOLOGICAL SOCIETY, at 8.—Palaeolithic Implements, &c., from Hackpen Hill, Winterbourne Bassett, and Knowle Farm Pit (Wiltshire): Rev. H. G. O. Kendall.—On the Karroo System in Northern Rhodesia, and its Relation to the General Geology: A. J. C. Molyneux.—On Coal-Balls from Japan: Dr. Marie C. Stopes. BRITISH ASTRONOMICAL ASSOCIATION, at 5.—A Series of Azo-dyes derived from the Aminosulphonamides: Dr. G. T. Morgan and Frances M. G. Micklethwaite.

THURSDAY, FEBRUARY 25.

ROYAL SOCIETY, at 4.30.—Probable Papers: The Statistical Form of the Curve of Oscillation for the Radiation emitted by a Black Body: Prof. H. A. Wilson, F.R.S.—The Flight of a Rifled Projectile in Air: Prof. J. B. Henderson.—On the Cross breeding of Two Races of the Moth *Acridalia virgularia*: L. B. Prout and A. Bacot.

ROYAL INSTITUTION, at 3.—Problems of Geographical Distribution in Mexico: Dr. Hans Gadaw, F.R.S.

ROYAL SOCIETY OF ARTS, at 4.30.—The Bhuddist and Hindu Architecture of India: Prof. A. A. Macdonell.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Further discussion: The Use of Large Gas Engines for Generating Power: L. Andrews and R. Porter.

FRIDAY, FEBRUARY 26.

ROYAL INSTITUTION, at 9.—Osmotic Phenomena, and their Modern Physical Interpretation: Prof. H. L. Callendar, F.R.S.

PHYSICAL SOCIETY (at Finsbury Technical College, Leonard Street, City Road, E.C.), at 5.—A Laboratory Machine for applying Bending and Twisting Moments simultaneously: Prof. Coker.—On the Self-demagnetising Factor of Bar Magnets: Prof. Silvanus P. Thompson, F.R.S., and E. W. Moss.—Exhibition of Optical Properties of Combinations of Mica and Selenite Films (after Reusch and others) in Convergent Polarised Light: Prof. Silvanus P. Thompson, F.R.S.—Exhibition of Apparatus: C. R. Darling.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Standardisation in Engineering Practice: Dr. W. C. Unwin, F.R.S.

SATURDAY, FEBRUARY 27.

ROYAL INSTITUTION, at 3.—Properties of Matter: Sir J. J. Thomson, F.R.S.

CONTENTS.

	PAGE
Applied Physiology of the Circulation	451
Justus von Liebig. By Dr. T. E. Thorpe, C.B., F.R.S.	452
The Construction of Ships. By Sir W. H. White, K.C.B., F.R.S.	454
Heredity and Education	455
Recent Studies in Atmospheric Electricity. By Dr. C. Chree, F.R.S.	455
Our Book Shelf:—	
Benett: "The Ethical Aspects of Evolution, regarded as the Parallel Growth of Opposite Tendencies"	456
Wall: "The Poisonous Terrestrial Snakes of our British Indian Dominions and how to recognise Them."—R. L.	456
"Gray's New Manual of Botany"	457
Upward: "The New Word"; Marques: "Scientific Corroborations of Theosophy: a Vindication of the Secret Doctrine by the Latest Discoveries"	457
Letters to the Editor:—	
The Boiling Point of the Radium Emanation.—Prof. E. Rutherford, F.R.S.	457
Crocodiles and Tsetse-flies.—Prof. E. A. Minchin	458
The Production of Prolonged Apnoea in Man.—Dr. H. M. Vernon	458
The Isothermal Layer of the Atmosphere.—W. H. Dines, F.R.S.	459
Barometric Oscillation.—C. Braak	459
Electrons and Atomic Weights.—Alfred Sang	459
Further Antarctic Results. (Illustrated.) By Prof. J. W. Gregory, F.R.S.	460
Irrigation in Egypt	462
Electrochemical Industry. By F. M. P.	463
Notes	464
Our Astronomical Column:—	
Interaction of Sun-spots	469
Distribution of the Stars	469
Jupiter's Seventh and Eighth Satellites	469
The Anomalies of Refraction	469
The Story of the Telescope	469
Regional and Stratigraphical Geology. (Illustrated.) By G. A. J. C.	470
A Remarkable Development in X-ray Apparatus	472
Recent Papers on Marine Animals	472
Meaning and Method of Scientific Research. By Dr. L. A. Bauer	473
University and Educational Intelligence	477
Societies and Academies	478
Diary of Societies	480